RESEARCH HIGHLIGHTS

February 2004

Technical Series 04-102

CALGARY INTEGRATED DESIGN AND SUSTAINABLE, AFFORDABLE HOUSING CHARRETTE

A two-day integrated design charrette (interactive workshop) was held in early 2003 with the objective to develop designs for mixed-use, sustainable, affordable housing in Calgary. The charrette was based on a development project called "Heritage Crossing" owned by Dome Britannia Properties Inc. The owner wished to develop ideas for a 461-acre flagship residential community with the following broad objectives:

1. Utilize the best in sustainable development technology without compromising affordability.
2. Encourage occupants to adopt environmentally friendly practices.
3. Integrate people from different ages and stages of life.
4. Create affordable housing with the rent for a two-bedroom unit not to exceed $600/month.

THE DESIGN PROCESS

The charrette was conducted using integrated design teams to challenge designers to find innovative building solutions—affordable, sustainable housing. Integrated teams are comprised of members with diverse expertise and experience. For example, the Calgary charrette was conducted by two teams (Team A and Team B) with specialists in the areas of property management, energy simulation, cost estimating, envelope design, municipal engineering, land-use planning, alternative energy, acoustics, architecture, affordable housing and seniors housing.

SITE DESCRIPTION

The charrette was based on an existing Calgary site slated for development called Heritage Crossing. Background information on the site and community, and preliminary design considerations, were provided by the developer, Dome Britannia Properties Inc. and the architecture firm, Riddell Kurczaba. The 1.9 hectare (4.6 acre) parcel of land is located on the southwest corner of MacLeod Trail and Heritage Drive S.W. in the City of Calgary (Figure 1).

The site is close to major roads, and the Light Rail Transit (LRT) system. Just a few blocks away is Calgary's recreational pathway system. There are excellent views of the mountains, the Calgary reservoir and the downtown skyline. The site is centrally located and is close to schools, day care centres, churches, athletic parks, the YMCA, numerous restaurants, grocery and other retail stores, a health clinic and a hospital.

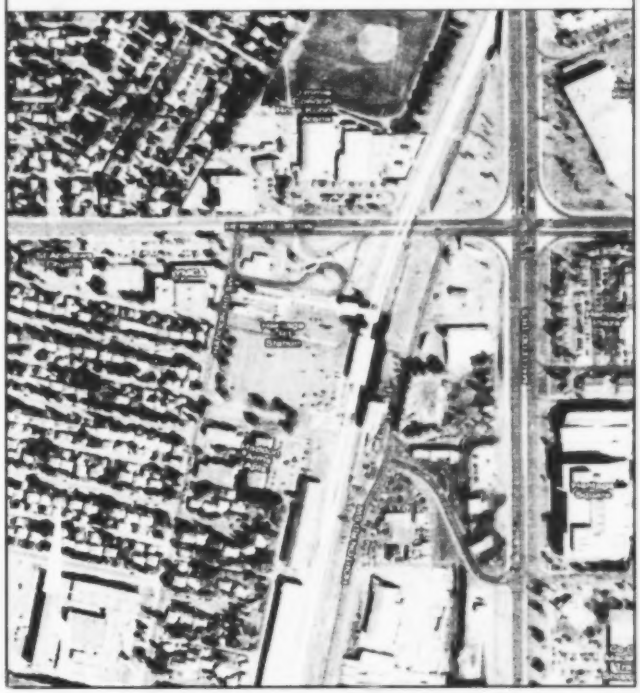
63390

CMHC SCHL

HOME TO CANADIANS

Canada

Figure 1 : Hertitage Crossing site location



IDEALS AND CONSTRAINTS

The pursued affordability and sustainability design ideals included:

1. Decrease building costs from $1,890/m^2 ($175/ft.^{2}) for concrete and $1,512/m^2 ($140/ ft.^{2}) for wood.
2. Blend mixed "affordable" housing with "55 Plus"—independent and assisted seniors living.
3. Identify partnership services that could be located in the community to make it more of a destination point.
4. Determine the most efficient use of land (high-rise, high-density versus low-to mid-rise wood frame, mixed use).
5. Use daylighting strategies for corridors, stairs, and all units.
6. Sound reduction: minimum of Sound Transmission Class of 55db and Impact Insulation Class of 60db for exterior wall assemblies (including windows) and control flanking noise.
7. Use construction materials with low emissions.
8. Ventilation: meet ASHRAE 62-2001, air supply to all rooms, low air leakage.
9. Maximize occupant (and neighbourhood) comfort, safety and health while emphasizing resource conservation.
10. Reduce energy use by 25 per cent reduction in relation to the model energy code.
11. Use free passive solar design principles while ensuring that apartments do not overheat on sunny days.
12. Landscape for energy efficiency (windbreaks, natural ventilation and shading).
13. Water conservation: target 50 per cent of the 220,000 litres/year average for Calgary water consumption. Collect stormwater onsite for reuse.
14. Manage construction waste.
15. Use building envelopes incorporating air barrier and rainscreen systems.
16. Air leakage maximum of 0.10 l/s*m^2 at 75 pa pressure differential.
17. Reduce the need for cars—provide links to walking and biking paths, shops and services. Identify solutions to promote public-transit use and decrease parking ratios. Provide sheltered bike storage.
18. Provide green space.

Both teams were required to establish sustainable performance goals and develop a design concept to satisfy the following constraints:

1. Maximum density of 500-600 units
2. Unit sizes: one bedroom units from 500 ft.^{2}, two bedroom units 700-800 ft.^{2}, and three bedroom units up to 1,000 ft.^{2}
3. Road access from Horton Road
4. Accommodate seniors, handicapped residents, singles with and without children, young couples and anyone who uses the LRT as the primary means of transportation.
5. Consider traffic noise from MacLeod Trail.

THE DESIGN PROCESS

Both teams decided to attain LEED (Leadership in Energy and Environmental Design) Gold certification for high-performance, sustainable buildings (http://www.usgbc.org/LEED/LEED_main.asp). LEED seeks design excellence in the following areas:

- Transportation (example: reduced reliance on autos)
- Reduced site disturbance
- Stormwater management (example: handle all stormwater onsite)
- Landscaping (example: shield from wind, use solar gains)
- Light pollution reduction

- Reduced water consumption (example: uses for greywater)
- Energy reduction (example: alternate energy use)
- Materials and resources (examples: recycling facilities, diversion of construction waste)
- Indoor environmental quality (examples: ventilation effectiveness, low VOC- emitting materials).

On Day 1, the teams developed their strategies and began conceptionalizing designs. On Day 2, teams finalized their site concepts. Detailed design continued, including site planning and building systems design. By mid-afternoon, the teams reconvened to present their work and discuss the outcomes.

DESIGN OUTCOMES

Both teams advanced design ideas in support of LEED certification and meeting the charrette goal of designing affordable and sustainable housing:

Site

1. Stormwater management using roof-top gardens and on-site retention.
2. Use drought-resistant, salt, and pollution resistant landscaping to act as a buffer on the McLeod Trail side.
3. Limit vehicular traffic within site.
4. Provide a pedestrian overpass to the LRT station.
5. Link to bicycle paths

Building Envelope

1. Consideration of solar panels on southern walls for domestic water heating and electricity
2. Windows: fiberglass frames, R-3, low-e, laminated, argon filled
3. Window sills: 600 mm (2 ft.) above floor (accessible) to reduce thermal loss and gain.
4. Use glass with high shading coefficients and tree placement to reduce solar over-heating on south-facing walls.
5. Use swing doors for patios (more thermally efficient).
6. Use roof-top gardens over the garage deck and possibly on the high-rise terraces to reduce heat loss / gain.

Water Conservation

1. Low flow faucets, toilets and showers
2. Possible heat recovery from shower waste water
3. Efficient appliances such as horizontal axis clothes washers to reduce water and energy consumption.
4. Use of solar heating for some domestic water

Energy Use

1. Individual metering to encourage occupant co-operation.
2. Central heat recovery units for exhaust
3. Use of washroom exhaust to heat parkade.
4. Efficient lighting, fans, pumps and other mechanical equipment
5. Hot water heating/cooling through in-ceiling radiant panels
6. Use of co-generation supplies for hot water and heating
7. Use of 85 per cent efficient boilers
8. Building and window orientation for solar heating and ventilation

Team A

The final design (Figure 2) consists of a mixed-use development, which is predominantly residential. There are 600 residential units with an average size of 65 m^2 (700 $ft.^2$) per unit.

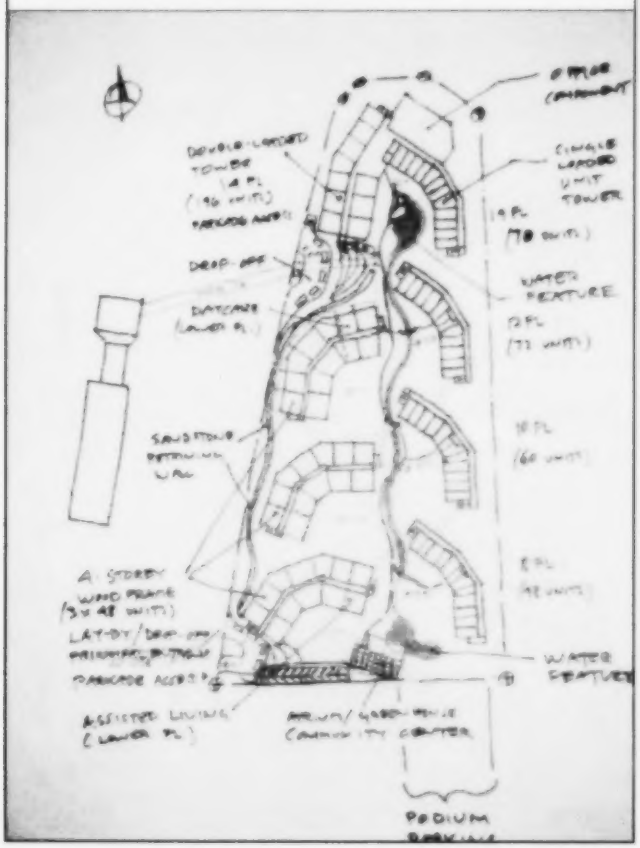
There are three main building types:

1. One 14-storey, 266 unit seniors apartments with commercial space, 19 units/floor
2. Three family apartment buildings (one 8-storey, 48 units; one 10-storey, 60 units; and one 12-storey, 72 units), 6 units/floor
3. Three 4-storey, 48 unit family apartments, 12 units/floor

Other features of the concept for the development are:

1. Common space—green house, community centre, and green space
2. Commercial space in the ground level of the 14-storey building
3. 300 parking spaces
4. Storage for 600 bicycles

Figure 2 : Team A site plan



The tallest building is situated at the north end of the site, to act as a gateway to the development and provide a presence on Heritage Drive and MacLeod Trail. It also acts to shelter the other buildings from noise. It is comprised of an office section and two wings providing seniors housing.

The 8-10-and 12-storey buildings are situated on east side of the site, buffering traffic noise from MacLeod Trail, and taking advantage of the available views to the west and southeast, and solar gain from the south. Horton Road is edged with three 4-storey family apartments, which look in to the development's green space.

The natural drainage feature is used for stormwater management and is flanked by courtyards. A community centre and greenhouse / atrium at the southern end of the development provided community and recreational space.

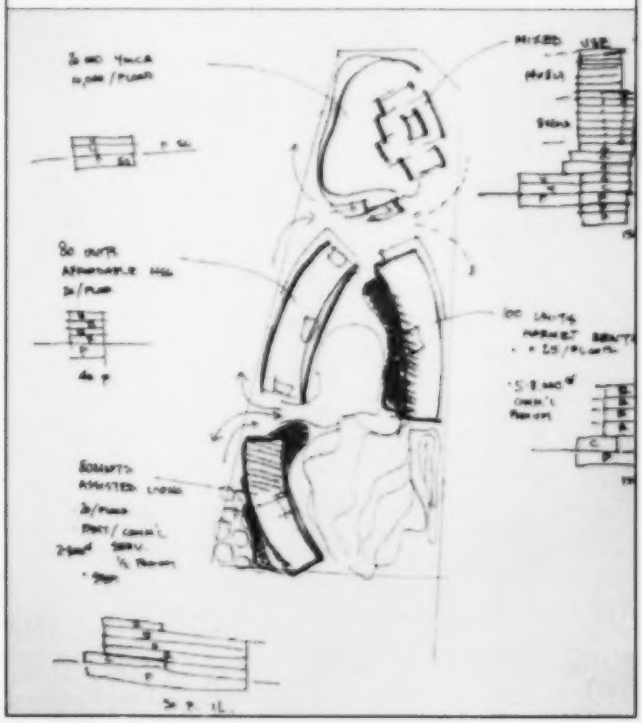
The mechanical systems for the concrete buildings on the east side of the development consist of radiant floor heating, heat exchange in the parkade, and forced and natural ventilation using operable windows and stack effect. The orientation of the building, envelope considerations, and the garden roof served to minimize heating needs and therefore reduce the cost of the mechanical system.

The construction cost for the 8-storey concrete building is estimated to be $\$1,600/m^2$ ($\$148$ per $ft.^2$). The cost estimator relayed that the wood-frame structures and high-rise seniors apartments would have a lower unit cost. The costing was therefore in line with the economic goals set out at the beginning of the charrette.

Team B

Team B's final site plan (Figure 3) includes a tower situated at the intersection of Heritage Drive and MacLeod Trail. As the largest building, it would serve as an important landmark and advertising marker for the site. The building is comprised of three levels of underground parking, a platform consisting of the allocated fitness program (in this case the YMCA) and commercial space, with mixed use above.

Figure 3 : Team B site plan



The three buildings on the south portion of the site satisfy Team B's goal of retaining the existing hill to provide a "village" atmosphere. Courtyards around the existing hill allow individual buildings to be arranged to allow for light penetration, and sheltering from winter winds. The shape of each building is intended to reduce heating needs while still allowing prominent views.

The three southerly buildings are organized as follows:

- A 5-storey market rental apartment building was placed along MacLeod Trail. The building followed the pattern of the northern multi-use tower and used a commercial podium and one level of underground parking.
- A 4-storey affordable housing complex is situated to the west of the 5-story building. It has one level of underground parking and provides a buffer to Horton Road and the LRT.
- The final building, a 4-storey assisted-living building is situated on the south-west corner of the property.

The phasing for Team B's design is as follows.

Phase I

1. Assisted Living/ Commercial - 5 storeys, 80 units, 20/floor
2. Market Rental - 4 storeys, 100 units, 25/floor
3. Affordable Housing - 4 storeys, 80 units, 20/floor

Phase II

1. Mixed Use Tower - 27 storeys (8 floors of 6 units/floor, and 14 floors of 8 units/floor, 5 floors commercial)

CONCLUSIONS

The charrette accomplished what it was intended to do—provide all participants with increased appreciation for sustainability and affordability. Obviously, not all aspects of designs could be verified for affordability and verification to ensure LEED certification in a two-day time period. For example, not all aspects of the designs were cost-estimated and an energy simulation was not performed.

The team members felt the integrated design process added dimension to the conceptual design. For example, the involvement of municipal authorities provided insight to the City of Calgary's plans and early identification of hurdles.

The developer was pleased with the strategies, design criteria and conceptual designs the two integrated teams developed, stating the charrette was "an exceptionally invaluable tool that has assisted us in moving forward".

The Calgary charrette on sustainable and affordable housing produced the following outcomes:

1. It provided all participants, including the developer, with an appreciation for the use of integrated design teams to identify different development and building solutions.
2. It provided all participants a better understanding of how careful planning can reduce the environmental impacts of development and operation.
3. It provided the developer with sustainable design features that can economically be considered for this and other developments.
4. It reinforced and raised awareness of sustainable design in Alberta.

Team A

Facilitator:

Vivian Manasc, Manasc Isaac Architects

Estimator:

Michael McCreadie, Clark Builders

Energy Simulator:

Jim Sawers, Keen Engineering

Note-Taker:

Shari Imada, Sustainable Insights

Team Participants:

Richard Allen, City of Calgary

Monica Pohlman, City of Calgary

Glen Ortt, Dome Britannia Properties

Robert Drew, Busby +Associates Architects

Jorg Ostrowski, ASH Inc.

Fred McCreath, Dome Britannia Properties

Richard Sordi, Designed Space

Wayne Kopp, adjacent land owner

Anna Marie Kopp, adjacent land owner

Brenda Pollard, Alberta Seniors

Tim Fossey, Riddell Kurczaba

Paul Maas, City of Calgary

Kathy Mayerson, Celedon Consulting

Team B

Facilitator:

Peter Busby, Busby + Associates Architects

Estimator:

Trevor Smith, Cuthbert Smith Consulting
Robert Wiles, City of Calgary

Energy Simulator:

Jim Sawers, Keen Engineering

Note-Taker:

Scott Pickles, University of Calgary

Team Participants:

John Riddell, Riddell Kurczaba

Gary Nissen, Dome Britannia Properties

Pamela Novak, Dome Britannia Properties

Joe Van Belleghem, JVB Development

Colleen Roberts, City of Calgary

Marty Bobyn, City of Calgary

Brajesh Sharma, City of Calgary

Matt McNeil, Calgary Homeless Foundation

Carolyn Hooper, Dome Britannia Properties

Tina Prine, Dome Britannia Properties

Teams also had access to resource persons who floated between teams offering context and expertise on their respective specialties. Some experts decided to join a particular team for the charrette and provided advice to the other team upon request. Resource persons are listed below.

Project Manager: Sandra Marshall

Consultant: Shari Imada and Scott Pickles

Developer: Evan Welbourn, Dome Britannia Properties Inc.

CMHC: Bill Joyner, Sandra Marshall, Doug Pollard

Indoor Air Quality: Professor Tang Lee, University of Calgary

Acoustics: Clifford Faszer, Faszer Farquharson

City of Calgary Transportation: Adrian Foo, Glen Radway, Larry Brown

Building Envelope: John Vlooswyk, Building Envelope Engineering Inc.

Energy: Kenneth Robinson, Siemens

Landscape / Stormwater Management: Dennis Westhoff, Westhoff Engineering, Bernie Amell, Riparia

Community /Affordable Housing: Alderman Ric McIvor, City of Calgary, Dale Stamm, Calgary Housing Company

Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

To find more *Research Highlights* plus a wide variety of information products, visit our Web site at

www.cmhc.ca

or contact:

Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario
K1A 0P7

Phone: 1 800 668-2642
Fax: 1 800 245-9274

OUR WEB SITE ADDRESS: www.cmhc.ca

Although this information product reflects housing experts' current knowledge, it is provided for general information purposes only. Any reliance or action taken based on the information, materials and techniques described are the responsibility of the user. Readers are advised to consult appropriate professional resources to determine what is safe and suitable in their particular case. CMHC assumes no responsibility for any consequence arising from use of the information, materials and techniques described.

60975